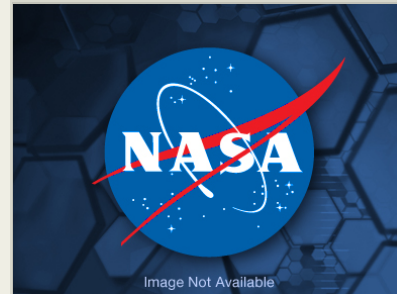## Project Introduction

The CoOperative Blending of Autonomous Landing Technologies (COBALT) instrument is a terrestrial test platform for development and maturation of guidance, navigation and control (GN&C) technologies for precision landing. The project is developing a third-generation Langley Research Center (LaRC) navigation Doppler lidar (NDL) for ultra-precise velocity and range measurements, which will be integrated and tested with the Jet Propulsion Laboratory (JPL) lander vision system (LVS) for terrain relative navigation (TRN) position estimates. These technologies together provide precise navigation know ledge that is critical for a controlled and precise touchdown.

Anticipated Benefits

The COBALT project will mature precision-landing GN&C technologies for infusion into near-term robotic science and future human exploration missions. The NDL is a prime candidate sensor for Mars, moon or other planetary missions because of the high resolution velocity and range measurements. One of the key deliverables of the COBALT project is to mature NDL technology in preparation for the development of a space-qualified unit. In addition to the hardware, the COBALT navigation algorithms for blending and flight testing LVS TRN and NDL together provide a compelling new solution for future precise landing missions.

The third-generation NDL provides both velocity and range measurements. The sensor hardware consists of a custom optical head and electronics box. The electronics includes a seed laser, fiber amplifier, synthesizer, wide-band receiver and a NASA-developed command and data hand ling (C&DH) board. The NDL is de signed for a velocity envelope of 200 m/s per telescope line-of-site (LOS), and an LOS range of 4+ km. The NDL will achieve TRL6 in 2019 and could be in fused on-board a robotic moon or Mars lander mission in the 2020s.

Lander Technology: ALHAT capabilities including Navigation Doppler Lidar (NDL)
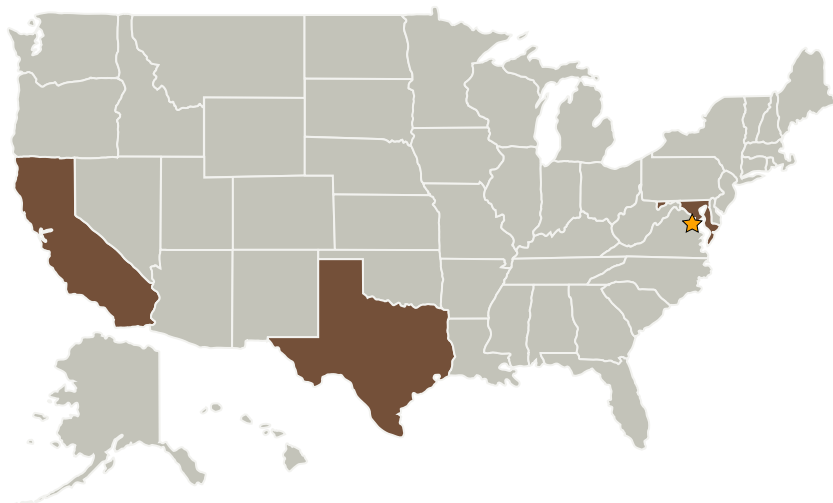
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Lander Technology: ALHAT capabilities including Navigation Doppler Lidar (NDL) (COBALT)

Completed Technology Project (2017 - 2020)

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
⭐NASA Headquarters(HQ)	Lead Organization	NASA Center	Washington, District of Columbia

Co-Funding Partners	Type	Location
Masten Space Systems, Inc	Industry	Mojave, California

Primary U.S. Work Locations	
California	Maryland
Texas	

Project Website:

https://gameon.nasa.gov/projects/cooperative-blending-of-autonomous-landing-technology-cobalt/

Organizational Responsibility

Responsible Mission Directorate:

Exploration Systems Development Mission Directorate (ESDMD)

Lead Center / Facility:

NASA Headquarters (HQ)

Responsible Program:

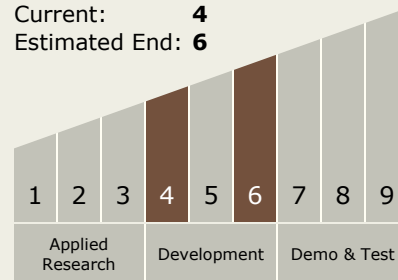Exploration Capabilities

Project Management

Program Director:

Christopher L Moore

Project Manager:

Greg Chavers

Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **6**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

Technology Areas

Primary:

Continued on following page.

Tech Port

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For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/93112

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Technology Areas *(cont.)*

- TX09 Entry, Descent, and Landing
  - └ TX09.4 Vehicle Systems
    - └ TX09.4.7 Guidance, Navigation and Control (GN&C) for EDL

Target Destinations
The Moon, Mars, Others Inside the Solar System

Supported Mission Type
Projected Mission (Pull)